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REVIEW ARTICLE

Subfascial Endoscopic Perforator Surgery in Perforator Vein Insufficiency

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ABSTRACT

Surgical treatment of incompetent perforating veins of the lower leg performed by open method carries considerable morbidity and also associated with poor wound healing. Subfascial endoscopic perforator surgery (SEPS) is a new, minimally invasive endoscopic technique performed in patients with advanced chronic venous insufficiency. This technique offers an effective treatment alternative which avoids the lengthy incisions of the classical open Linton subfascial ligation techniques. The favorable ulcer healing rate and improvement in clinical symptoms suggest that SEPS is a feasible, safe and effective treatment of the incompetent perforator veins in patients with advanced chronic venous insufficiency.

Keywords: Subfascial endoscopic perforator surgery (SEPS), Minimal access surgery, Incompetent perforator, Chronic venous insufficiency.

INTRODUCTION

Patients with chronic venous insufficiency and venous ulcers were surgically corrected using long incisions through diseased skin and subcutaneous tissues already compromised by venous hypertension. This procedure involved ligation of incompetent perforator veins described by Linton,[1,2] Cockett[3] and Dodd,[4] this technique was often complicated by wound infections and poor healing.

But in 1985, G Hauer[5] demonstrated a new surgical technique where incompetent perforator veins were directly visualized using an endoscope in the subfascial space. This seminal contribution marked the advent of subfascial endoscopic perforator vein surgery (SEPS). The idea to use this approach was based on the possibility to create, using the laparoscopic instruments, a virtual space and seemed to be very interesting since it offered the possibility to avoid further damaging to the scarred tissues surrounding the ulcer and thus to eliminate the wound complications that affected Linton's technique.

In comparative studies, SEPS was associated with fewer wound complications compared with Linton's procedure.[6,7]

AIMS

The aim of the study was to study the role of subfascial endoscopic perforator surgery (SEPS) in perforator vein insufficiency. The following parameters were evaluated:

- Operative technique
- Operative time
- Intraoperative and postoperative complications
- Postoperative pain
- Postoperative recovery
- Patient acceptance.

MATERIALS AND METHODS

A literature review was performed using SpringerLink, HighWire press, BMJ, Journal of MAS and major search engines, like Google, MSN, Yahoo, etc. The search term was the role of SEPS in perforator vein insufficiency. Citations found in selected papers were screened for further references. Criteria for selection of literature were the number of cases (excluded if less than 20), method of analysis (statistical or nonstatistical), operative procedure (only university accepted procedures were selected) and the institution where the study was done (specialized institutions for endoscopic procedure was given more preference).

EQUIPMENT FOR SEPS

Most of the instruments used in this procedure are usually used for laparoscopic cholecystectomy.

Instrumentation Includes

- Insufflator for introducing carbon dioxide to maintain the working space
- A rigid 5 or 10 mm endoscope
- A three-chip video camera preferably with xenon light source
- A TV monitor (Fig. 1)
- A 10 mm cannula, rigid endoscope is introduced into the subfascial working space
- 5 mm cannula is used for all other equipments.

Other additional instruments important for the successful performance of the operation are: A balloon dissector (General Surgical Innovations, Cupertino, CA, USA). Although dissection of the subfascial plane can be created via endoscopic instruments manually, the balloon dissector significantly expedites the dissection process and helps to create a large,

operative working space. The balloon dissector used in this technique (Fig. 2) has a capacity of 300 cc balloon with a protective removable cover, a guide rod to aid in introduction and placement and also a 10 mm laparoscopic cannula with skin seal.

A second important but optional instrument is the 5 mm roticulating endograsper (US Surgical, Norwalk, CT, USA) (Fig. 3A), where in the tip articulates and rotates which offers a high degree of maneuverability.

The 5 mm clip applier (Ethicon Endosurgery, Cincinnati, OH, USA) (Fig. 3B) needs a 5 mm port. Its small size also offers a high degree of maneuverability and visibility when working in a small endoscopic space. The applier delivers 8 mm long (medium/large) clip in a convenient and with multifire configuration.

PREOPERATIVE PREPARATION

Preoperative evaluation includes color Doppler scanning which can be used to document superficial, deep, or perforator incompetence and guide the operative intervention. Incompetent perforator on the skin is accurately mapped and marked which is mandatory as this assists the surgeon during surgery. Ultrasonologist can help by marking the sites of incompetent perforators and also that of an incompetent SP junction with the help of a skin marker.

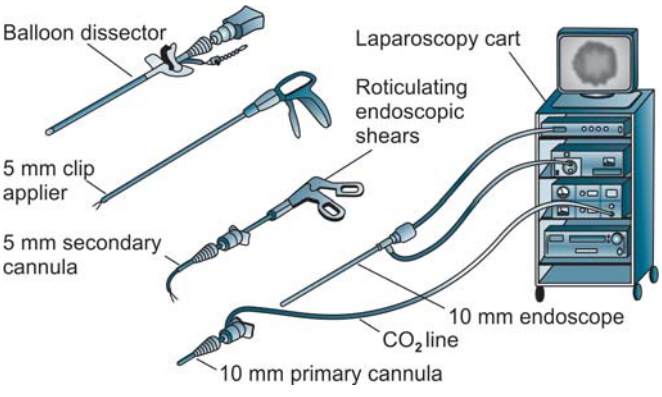
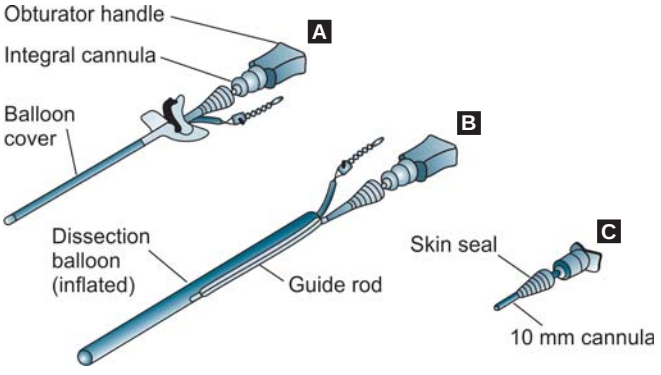


Fig. 1: Instrumentation overview for endoscopic subfascial perforator interruption



Figs 2A to C: Balloon dissector for subfascial perforator interruption: (A) Fully assembled (B) with cover removed and balloon inflated and (C) with balloon and obturator removed, leaving the 10 mm cannula

OPERATIVE TECHNIQUE

SEPS procedure is performed under general/spinal anesthesia with the patient supine and in the trendelenburg position with knee slightly flexed and elevated. In anticipation of concomitant stripping of superficial veins, the entire extremity is prepared circumferentially.

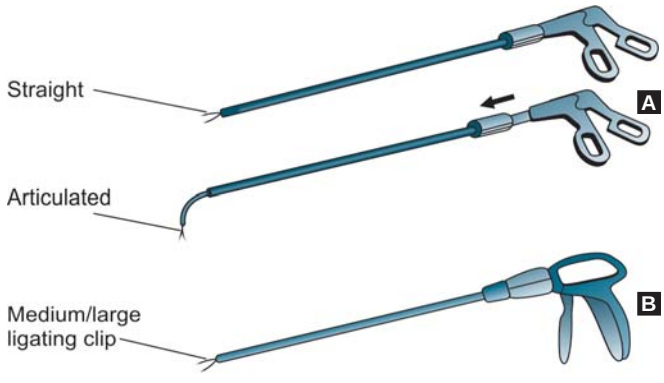
A 10 mm incision is made through the skin, which is 4 cm medial to the tibia and 10 to 12 cm below the popliteal crease. Subcutaneous tissue is dissected, the posterior compartment is identified and a 10 mm transverse incision is made into the fascia.

The subfascial space is identified and retractors are placed to keep it open.

The balloon dissector is introduced into the fascial incision and directed towards the medial malleolus (Figs 4A and 6A). After removal of balloon cover sheath, the dissection balloon is inflated with 200 to 300 cc saline. The balloon is designed in such a way that initial radial expansion occurs, followed by distal expansion towards the malleolus (Fig. 4B), as the balloon everts distally. Dissection occurs along planes of least resistance by balloon, hence, the perforating veins are not disrupted in the dissection process.

The balloon is deflated and removed once the dissection is accomplished, the rotating seal of 10 mm trocar is secured to the fascial incision. The cannula is introduced into the space dissected, and the guide rod and obturator are removed. The skin seal is rotated into the fascial incision to provide a gas seal. CO_2 is then insufflated at a pressure of 15 mm Hg to create the working space. A 0º 10 mm rigid laparoscope with attached video camera and light cable are introduced (Figs 5A and 6B), and the subfascial space is visualized (Fig. 6C) on the video monitor.

A working 5 mm laparoscopic port is then inserted in the mid calf under direct endoscopic guidance. This trocar is placed as posteriorly as possible to make a wide working axis. This arrangement of trocar aids visualization of the working instrument and facilitates instrument manipulation (endograsp dissector or clip applier) in the confines of the calf (Figs 5B and 6D).



Figs 3A and B: 5 mm instrumentation for subfascial perforator interruption: (A) Roticulating grasper facilitates exposure of perforating veins. (B) Clip applier delivers 8 mm long clip for interruption of perforators

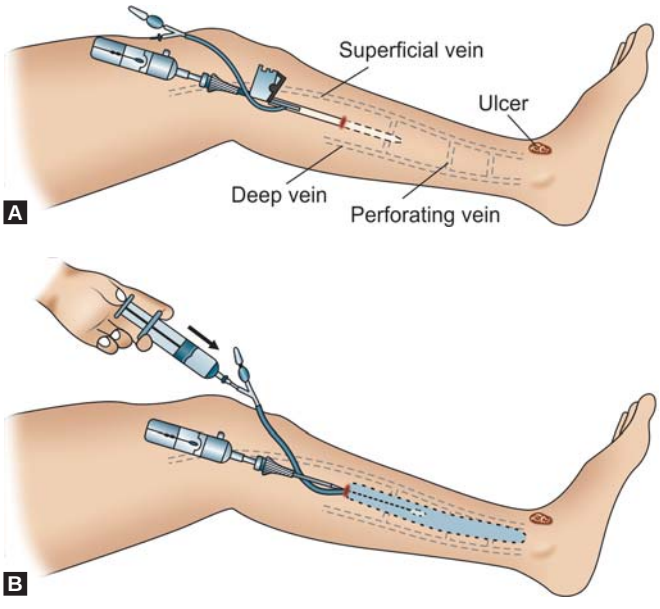
The perforating veins may be visible immediately or may require some amount of blunt dissection and exploration. Skin markings done with the help of duplex venous studies are useful in guiding the surgeon to the location of the perforators. Once identified, each perforating vein is double clipped with the 8 mm titanium clips with a 5 mm clip applier. Generally, all perforating veins which can be identified are clipped (Fig. 6D).

As the perforator continuity is interruped by the clips, the veins are usually not divided. However, division of the perforator between the clips can be performed, when desired, with endoscopic shears to facilitate distal exposure.[8-12]

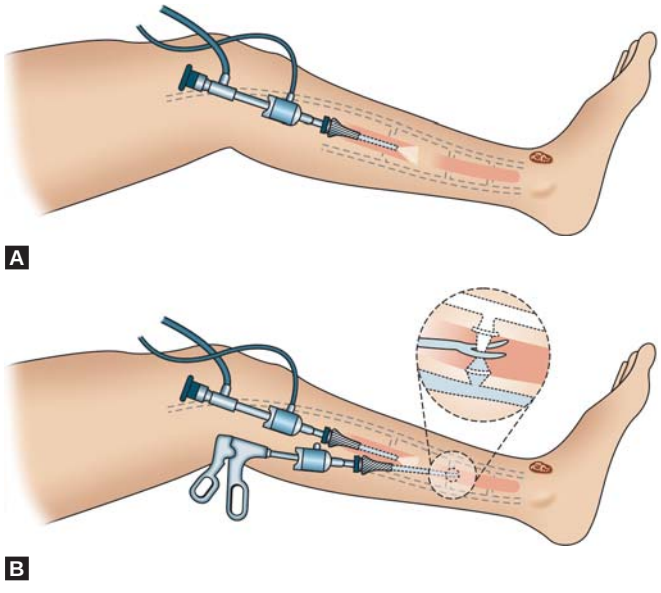
When interruption and/or division of the perforators is complete, the trocars are removed, the skin incisions are closed with interrupted mattress stitches using monofilament sutures. Superficial ligation and stripping can be performed in the standard fashion in patients with superficial venous insufficiency, nonadherent dressing are covered to all wounds, and the operated leg is wrapped with a compression bandage extending from the forefoot to the upper calf or leg. Usually, patients are discharged on the same day of surgery and advised routine follow-up in outpatient department 1 week after surgery.

POSTOPERATIVE MANAGEMENT

Once the effect of anesthetic wears off, the patients are encouraged to ambulate and are discharged on the same day or the day after surgery. Patients receive two postoperative doses of antibiotics in addition to the intraoperative intravenous antibiotic. First 24 hours after surgery, they are provided with adequate parenteral analgesia, this is changed to oral analgesia upon discharge. Postoperative instructions stress on the need for active ambulation, elevation of the operated limb and maintenance of the elastic bandage regularly. Patients are seen for removal of skin sutures in the outpatient department a week



Figs 4A and B: The balloon dissection technique: (A) Introduction and advancement along the subfascial plane. (B) The balloon cover is removed, and the dissection balloon is filled with saline



Figs 5A and B: The endoscopic instrument technique: (A) After balloon removal, the video endoscope is inserted into insufflated subfascial working space. (B) Perforating veins are clipped via a secondary 5 mm port

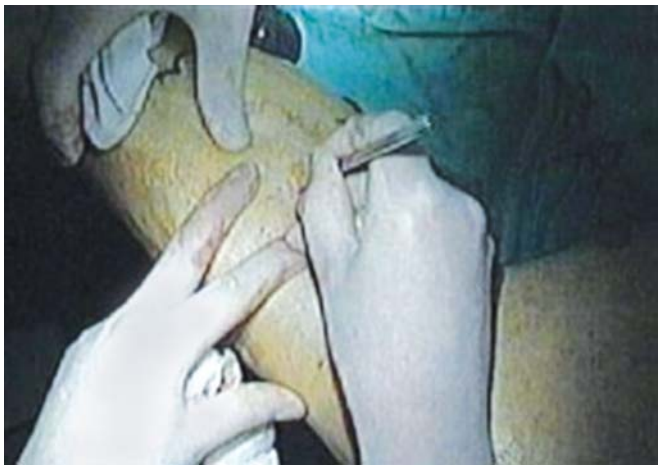


Fig. 6A: Incision of muscularis fascia

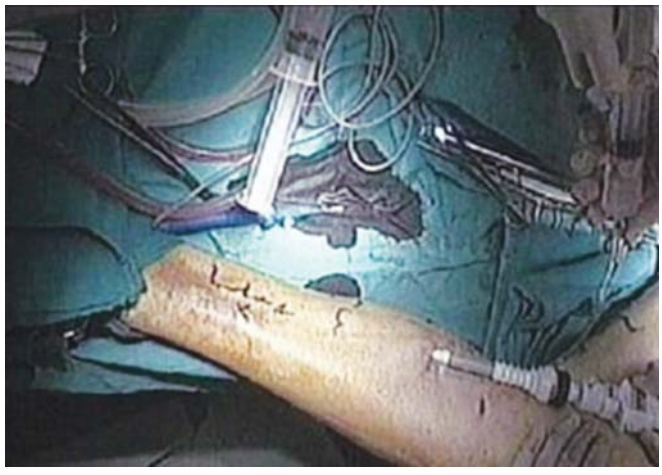


Fig. 6B: Creation of subfascial space

to 10 days after surgery. Those patients with an active ulcer need regular further dressings till the ulcer heals. Class II graduated compressive stockings are prescribed to all patients in a long-term basis.

DISCUSSION

SEPS has gained a lot of attention around the world. A lot of controlled trails have been conducted; many are in favor of SEPS. The goal of this review was to ascertain that if the SEPS procedure for perforator incompetence is superior to convention open (Lintons) surgical procedure, and if so what are the benefits and how it could be more widely instituted. There is lot of diversity in randomized controlled trails. The main variables in these trails are:

- Number of patients in trail
- Withdrawal of cases
- Blinding
- Intention to treat analysis
- Publication biases
- Local practice variations
- Prophylaxis antibiotic used
- Follow-up failure.

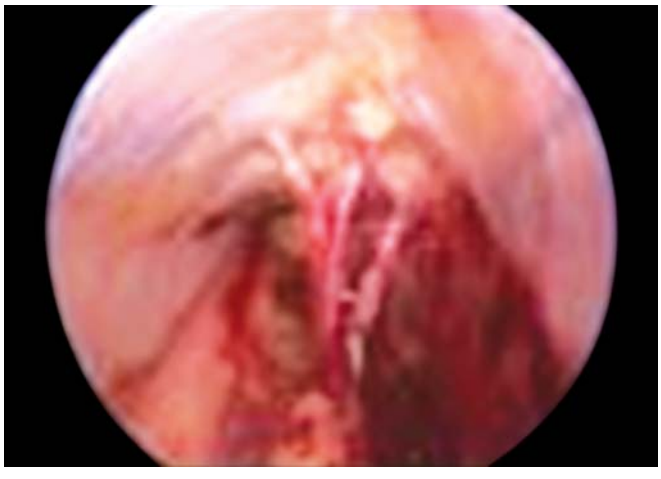


Fig. 6C: Perforator vein seen after creation of subfascial space

Without proper detail to all these parameters, it is difficult to draw a conclusion. One should always think that SEPS and open conventional procedure as being complementary to each other.

A successful outcome requires greater skill of the operating surgeon adequate training in the field of minimal access surgery. SEPS requires different skills and technological knowledge. In fact many studies have shown that the outcome of SEPS was influenced by experience and technique of the operator.

In a study done by Anjay Kumar[13], 21 patients of varicose veins with an incompetent perforator underwent SEPS using a harmonic scalpel. Various parameters were studied. The result of their study was that, all ulcers healed in 8 weeks with no recurrence in 11.9 months follow-up period. There was one case of wound infection and one saphenous nerve neuropraxia as complications noted postoperatively. They concluded that using ultrasonic scalpel in SEPS is technically feasible, causing less tissue damage as the thermal effect it generates is very low, and also the study was associated with minimal morbidity.

In another study by T Luebke and J Brunkwall[14], a meta-analysis of subfascial endoscopic perforator vein surgery (SEPS) for the treatment of chronic venous insufficiency was done. Here, a multiple health database search was performed, including Medline, Embase, Ovid, Cochrane Database of Systematic Reviews and Cochrane Database of Abstracts of Reviews of Effectiveness, on all studies published between 1985 and 2008, that reported on health outcomes in patients with CVI treated with SEPS and comparing this therapy with the conventional Linton procedure. Three studies, which compared SEPS with conventional surgery, were included in the meta-analysis. Results of the study was that between SEPS and Linton groups, there was a significant lower rate of wound infections in the SEPS group [odds ratio (OR) 0.06 (95% confidence interval (CI) 0.02 to 0.25)] and a significantly reduced hospital stay for SEPS [OR: 8.96 (95% CI: 11.62 to – 6.30)]. In addition, there was a significant reduced rate of recurrent ulcers in SEPS group (mean follow-up 21 months) [OR 0.15 (95% CI 0.04-0.62)]. There was no significant difference between the groups in the

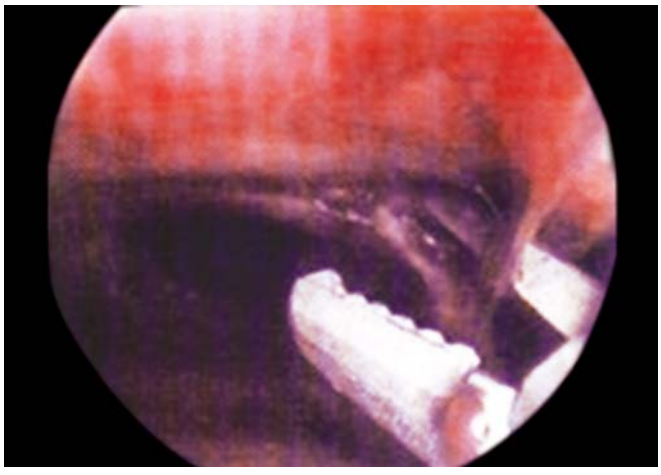


Fig. 6D: Clipping of perforator

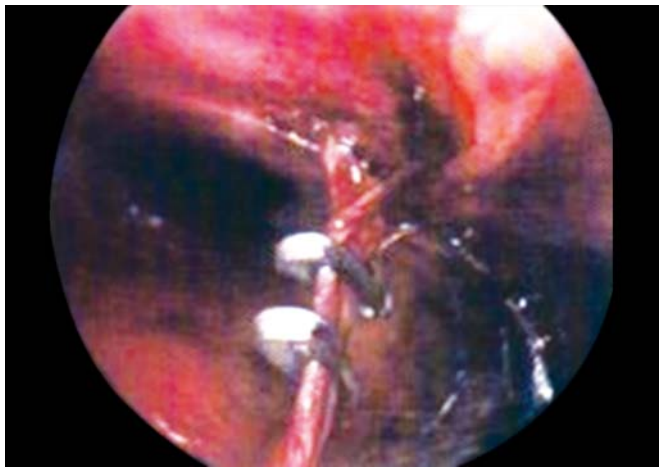


Fig. 6E: After clipping of perforator

following dimensions: Death at 6 months [OR 3.00 (95% CI 0.11-78.27)], rate of hospital readmission [OR 0.21 (95% CI 0.03 - 1.31)], healing rate of ulcer at four months [OR 0.44 (95% CI 0.09-2.12)], and the rate of deep vein thrombosis (DVT) [OR 0.35 (95% CI 0.01-8.85)]. Conclusion drawn from the study was that when SEPS used as a part of a treatment regimen for severe CVI benefits most patients in the short term regarding ulcer healing and also prevention of ulcer recurrence. And SEPS, if safely performed, has less early postoperative complications compared with the Linton procedure. However, still further prospective randomized trials are required to define the long-term benefits of SEPS.

In a randomized study by Kianifard B, Holdstock J and Allen C et al,[15] the effect of adding subfascial endoscopic perforator surgery to standard great saphenous vein stripping was studied. The authors studied the fate of incompetent perforating veins (IPVs) in patients undergoing standard varicose vein surgery *vs* those treated with standard varicose vein surgery and SEPS. Patients were included in this study, if they were undergoing surgery for varicose veins and also had venous reflux (0.5 seconds) in the great saphenous vein (GSV). All patients in the study also had IPVs. Patients were randomly allocated to standard surgery (saphenofemoral ligation, stripping and phlebectomies alone) or standard surgery with the addition of SEPS. Patients were excluded from the study, if they had recurrent varicose veins, deep venous reflux, deep venous thrombosis, ulceration or saphenopopliteal reflux. Using duplex ultrasound, incompetent perforating veins were determined preoperatively, and at 1 week, 6 weeks, 6 months and 1 year after surgery. Visual analogue scores for pain and quality of life questionnaires were obtained at the same time periods.

There were 34 patients in the no SEPS group and 38 patients in the SEPS group. During the follow-up period, the groups did not differ with respect to quality of life scores, pain, or mobility, but at 1 year, there was a higher proportion in the no SEPS *vs* SEPS group that had IPVs (25 of 32 *vs* 12 of 38; p = 0.001). The conclusion drawn was that subfascial endoscopic perforator surgery (SEPS) when used as an adjunct to standard varicose vein surgery reduces the number of incompetent perforating veins at 1 year but has no effect on quality of life or recurrence of varicose vein at 1 year.

Florian Roka[16] et al in their study, they investigated the mid-term (mean, 3.7 years) clinical results and the results of duplex Doppler sonographic examinations of subfascial endoscopic perforating vein surgery (SEPS) in all patients with mild to severe chronic venous insufficiency (clinical class 2 to 6) and also assessed the factors associated with the recurrence of insufficient perforating veins (IPVs). Around 80 patients with mild to severe chronic venous insufficiency undergoing SEPS were evaluated, duplex findings as well as clinical severity and also disability scores before and after the operation, were compared. Those patients with prior deep vein thrombosis (< 6 months) or prior to SEPS procedure were excluded from their study. Results of the study was that there were 27 men and 53 women with a median age of 59.8 years (range: 34.3-80.0 years). The distribution of clinical classes (CEAP) were: Class 2, 13.1% (12 limbs); Class 3, 22.8% (21 limbs); Class 4, 19.6% (18 limbs); class 5, 21.7% (20 limbs); and Class 6, 22.8% (21 limbs). The etiology of patients with venous insufficiency was primary valvular incompetence in 83 limbs (90.2%) and secondary disease in nine limbs (9.8%). Concomitant superficial vein surgery was performed in 89 limbs (95.7%). For 20 patients (95%), leg ulcers healed spontaneously within 12 weeks after operation, whereas one patient required an additional split-thickness skin graft. Eighteen patients had previous surgery of the great and/or short saphenous vein before SEPS. During a mean follow-up of 3.7 years, recurrence of 22 IPVs was observed in 20 (21.7%) of 92 limbs, and recurrent leg ulcers were observed in two (9.5%) of 21 limbs. They also performed univariate and multivariate analyses to predict factors which influencing the recurrence of IPVs [recurrent superficial varicosis, secondary disease, active or healed leg ulcer (C5/6), compression treatment, and previous operation]. The multivariate analysis showed that patients with previous surgery (p = 0.014) were identified as the only significant factor for the recurrence of IPVs. Conclusion of the study was SEPS is a safe and highly effective treatment for IPVs. In the study, within a median follow-up period of 3.7 years, only two of 21 venous ulcers recurred, both in patients with secondary disease. Nevertheless, they observed recurrence of IPVs in 21.7% of the operated limbs. The multivariate analysis showed that patients who had undergone previous surgery were found to have a significantly higher rate of recurrence.

CONCLUSION

SEPS is a feasible, safe and effective treatment of the incompetent perforator veins in patients with advanced chronic venous insufficiency.

In our review, it has been found that SEPS is a promising technique for treatment of patients with perforator incompetence. It may be optimally utilized in cases with failure of conservative therapy or those with advanced chronic venous insufficiency. The favorable ulcer healing rate and improvement in clinical symptoms suggest that SEPS plays a considerable role in correcting the underlying pathology in chronic venous insufficiency caused by incompetent perforating veins.

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